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ESSAYS

Physiological and Practical, on the

NATURE and CIRCULATION

OF THE

BLOOD.

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ERRATA.

Page 25, line 13, for *movement* read *moment*; page 51, line 14, for *impreſſed* read *oppreſſed*; page 65, line 7, for *brains* read *brain*.

ON THE NATURE, PROPERTIES, and CIRCULATION OF THE BLOOD.

§. 1. THE fluid which is contained in the vibrating arteries, and in the veins which correſpond and communicate with them, is called by the general name of blood; which, when firſt drawn from the body, appears to be an homogeneous liquid, but when no longer in motion through the veſſels, and permitted to reſt in the common temperature of the air, will gradually concrete into a red tremulous coagulum.

§. 2. After ſome time the coagulum will be ſeparated from the ſides of the veſſel the blood was received into, and a yellow coloured liquor, the ſerum, will ooze from the concreting ſubſtance and ſurround it on all ſides, till increaſing in quantity, the contracted maſs will appear like an iſland ſwimming in the circumambient fluid.

§. 3. We have here a ſpontaneous ſeparation of the blood into two parts, the cruor or craſſamentum, and the ſerum; and theſe again, though they appear homogeneous, conſiſt of different principles eaſily to be ſeparated from each other.

§. 4. By rectified ſpirits, mineral acids, or any degree of heat from 150 upwards, the blood may be coagulated; as on the contrary, by putrefaction or a continuance in a warm air it may be attenuated and reſolved into a fœtid liquor, which will at length moſtly exhale in a volatile ſteam, a ſmall quantity of earthy fæces only being left behind. When the blood has been diſſolved by putrefaction it cannot be again congealed or inſpiſſated, or when coagulated by ardent ſpirits, nothing will reſolve it.

§. 5. Chemically examined, the blood will afford the ſame principles as all other animal ſubſtances, as it is found to conſiſt of phlegm or water, oils of different conſiſtence, a volatile alcaline ſalt, air, and a fixed earth; but as ſeveral of theſe elements cannot exiſt in the blood in a ſound ſtate, they muſt not in a ſtrict ſenſe be deemed its compoſing principles; for the acrid fœtid oils and the volatile alcaline ſalts are creatures of the fire, and owing to chemical proceſſes, and ſuch a degree of heat as cannot poſſibly happen in an animal body.

§. 7. By the microſcope ſeveral phenomena have been detected, upon which a variety of theories have been conſtructed, to explain the appearances both in a ſound and morbid ſtate of the blood. Leuenhoeck, who was the firſt that by means of glaſſes attempted to inveſtigate its nature, was perſuaded that in the blood, whilſt circulating through the tranſparent parts of animals, or when received into a glaſs tube, he could readily diſtinguiſh a number of ſpherical globules floating in an almoſt tranſparent fluid. Some of theſe globules appeared larger and of a red colour, others ſmaller and yellow. The red globules he aſſigned to conſtitute the fibrous craſſamentum, the yellow ones the ſerum, and the pellucid fluid they ſwam in, the lymph and the other thinner parts of the blood. He was even induced to believe that the large red globules were each compoſed of ſix leſſer ſerous ones compreſſed and united together; on the contrary, that by reſt, or a defect of the compinging cauſe, the red globules would be decompoſed again into their conſtituent ſerous; ſo that the only difference between blood and ſerum conſiſted in a cloſer union of the globules of ſerum; that one red globule, when not ſufficiently compreſſed by the action of the veſſels, diſſolves and ſeparates into ſix leſſer yellow ones; and that ſix of theſe when again united will form one globule of blood.

The great Boerhaave and many other ingenious phiſiologiſts have favoured the Leuenhoeckian doctrine; and indeed this hypotheſis ſeems ſtill to be received amongſt the greater part of the profeſſors of Medicine, as from a ſuperficial view it will appear ſufficiently plauſible, but if cloſely examined will be found extremely deficient, and liable to great objections, as it will by no means ſuffice to account for the appearances in the blood, or explain in a ſatisfactory manner the theory of thoſe diſeaſes which have been founded on this perhaps only an imaginary baſis. A further enquiry then will become neceſſary to procure a proper knowledge and more conſiſtent opinions upon this ſo material a ſubject.

§. 7. It has been before obſerved, that the blood as it cools, ſeparates ſpontaneouſly into ſerum and craſſamentum: the ſerum in weight exceeds water about a 38th part, and is about a 12th lighter than the craſſamentum *; to the taſte it is ſlightly ſaline, and has an appearance ſomething viſcid from a ropy mucilage, in ſome meaſure ſimilar to the diluted gums of vegetables: in a heat of 150

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* Haller Elementa Phyſiologiæ, §. CLVII.

degrees it hardens into a maſs analogous to the white of an egg, which again expoſed to the fire, may be ſeparated into two parts, of which the largeſt appears a limpid phlegm, and the remainder becomes a fixed ſolid and fragile body, which bears a reſemblance to horn or amber, and cannot be again diſſolved in water. It is plain from the above, that the ſerum of the blood is compoſed of a viſcid mucilage, diſſolved and ſuſpended in a phlegm, which is ſlightly impregnated with a ſaline principle.

§. 8. The cruor, though it has the appearance of an homogeneous maſs, when examined, will afford diſtinct and different principles; the craſſamentum, properly ſo called, which of itſelf is of a whitiſh or greyiſh colour, and a red matter, the tinging particles of the blood, on which depends its red colour. Theſe, though they naturally attract and adhere to each other, may by various methods be obtained ſeparate; for if new-drawn blood be continually ſtirred with a feather or ſtick till it becomes cold, a conſiderable quantity of a fibrous tough ſubſtance, which by waſhing will become white, will adhere to the ſtick, and the remaining part of the blood thus deprived of its thicker parts will not concrete, but ſeparates by reſt into two ſubſtances, the ſerum which ſwims uppermoſt, and the red tinging particles which will be precipitated towards the bottom of the veſſel, but by agitation will riſe again, and fluctuate in the ſerum. Or if blood as it flows from a wounded veſſel be received into a baſon of warm water, and well mixed with it, when cold the craſſamentum may be ſeparated from the aqueous parts, of a whitiſh or greyiſh colour lightly tinged with red: the fluid remaining in the baſon appears thin, and of a very florid red colour, as conſiſting only of the ſerum and tinging particles of the blood, mixed and united with the water. Or again, if the cruor be repeatedly waſhed with cold water it parts with its red colour, and then appears a fibrous, light-coloured ſubſtance, ſomething ſimilar to the coagulated ſerum: the red particles diffuſed through the water will tinge it with their colour, though the ſame water cannot be made to waſh them out beyond a certain proportion, ſufficient to convert it into a bright red tincture, which upon ſtanding does not precipitate its colour, much leſs will there appear any inclination to yellowneſs or reſemblance to ſerum.

Will not this be ſufficient to contradict the received opinion, that the red globules are owing to ſix yellow ones united; or that upon the reſolution or attenuation of a red globule, it will be converted into ſerum? Certainly the principles of the ſerum and craſſamentum are different, and muſt vary in other reſpects, than in a greater or leſſer degree of condenſation in the globules; neither is it credible, that by the contraction of a blood-veſſel it can be poſſeſſed of a faculty of uniting the exact number of ſix into one; or can it be proved that one red globule was ever reſolved into ſix yellow ones.

§. 9. From the above obſervations and experiments it is plain, that the blood is compoſed of three parts, diſtinct and differing from each other, the aqueo ſaline, the glutinous, and the red globular; to the firſt of which the fluidity, to the ſecond the conſiſtence, and to the third the colour of the blood is owing. Theſe, however different in their ſeveral natures in a ſound ſtate, are kept equally mixed by the vital motion and circulation of the blood, though they cannot intimately cohere, or be united into an homogeneous fluid.

§. 10. From the principles above premiſed, may we not be able to form ſome judgment as to the nature and riſe of the globules, which by the microſcope have been ſuppoſed to have been detected in the maſs of blood? We certainly can, and may eaſily explain the ſeveral phenomena, in a manner at leaſt as ſatisfactory as by having recourſe to Leuenhoeck's union and reſolution of globules. The red globules may ſwim in, and be diſcerned ſeparately from the aqueous ſerum, between which there is naturally a repulſion, and as perhaps the circulating powers can only attenuate and divide them to a determinate degree, they will appear nearly of the ſame ſize; their ſpherical figure will depend upon the coheſion of the particles, between which the ſerum will be interpoſed, and with which they will not unite; and as they are ſoft and compreſſible, will eaſily change their form when acted upon by the veſſels; and again when freed from preſſure, will put on the globular appearance, or when at reſt, and no longer kept mixed by the motion and circulation of the blood, will form a maſs with the craſſamentum, and leave the ſerum free from redneſs. Something ſimilar to this may be obſerved in a mixture of oil with water; theſe by agitation appear to unite, but when at reſt, the oily particles attract each other and ſeparate from the water.

That the red globules from particular cauſes may be diviſible is not improbable, and when divided they may appear of a fainter colour; but it is greatly to be doubted whether they always ſeparate into ſix or any other determinate number: but nothing is more incredible, than that by this ſeparation the red globules ſhould be converted to ſerum, or that by the adunation of ſix ſerous globules a red one ſhould be formed: It is repugnant to experiment, and muſt be impoſſible, from the ſeveral and different natures of the ſerum and craſſamentum. A ſpeculative phyſiologiſt may indulge theſe kinds of hypotheſes, but pathology cannot be benefited thereby.

§. 11. The craſſamentum of the blood ſhould appear to be the moſt conſummate and elaborate part of the animal humours, and to be the reſult of ſtrong and ſound veſſels and viſcera, ſince it always moſt abounds in healthy robuſt people, where the circulation is vigorous, and the action of the veſſels performed with power and ſtrength: on the contrary, is much deficient in the weakly and infirm, where the circulation is languid, and the vital powers flag. It ſhould hence ſeem that there is a reciprocal action between a denſe thick blood and ſtrong vigorous ſolids, as an excited circulation will always tend to condenſe the fluids; and again, where the fluids are of a due conſiſtence, the ſtrength and action of the ſolids will be rarely deficient. A diminution of the craſſamentum, by exceſſive hæmorrhages, greatly weakens the body and relaxes the ſolids, and cannot be again but gradually repaired; or if the conſtitution ſhould be too much debilitated, it frequently happens that the ſolids will not be poſſeſſed of a due degree of energy to work up the fluids to a ſufficient denſity for the continuance of health, and the patient will ſoon become hydropic, or languiſh under a general weakneſs, to be only relieved by confirming the ſolids and condenſing the fluids.

§. 12. What may be the ſtandard proportion of the different principles of the blood to each other ſeems difficult to determine, as it will admit of conſiderable variation, without injury to health, in different ages, ſexes, temperaments, &c. ſo that a general rule can ſcarcely be eſtabliſhed. It frequently, however, happens, that, from an exceſs of one or the other, various and different diſeaſes will be produced; for if the fibrous craſſamentum is too abundant, and bears an over-proportion to the ſerum, diſeaſes from a plethora muſt be the conſequence; as on the contrary, when the ſerum ſuperabounds, dropſies, cachexies, and other complaints from a colluvies ſeroſa will enſue.

§. 13. The quantity of blood in general contained in the human body has not as yet perhaps been aſcertained; but it is obvious, that the weight of the fluid conſiderably exceeds that of the ſolid parts, though many of them, as the connecting gluden, the fat, and the like, are not regularly circulated thro' the veſſels of the body: but if we may be allowed to make any gueſs from hæmorrhages which have happened without the loſs of life, and from experiments made on living animals purpoſely exhauſted of their blood, compared with the bulk and capacity of the veins and arteries, the maſs of circulating humours in a middle ſized man, muſt be equal at leaſt to fifty pounds, of which the arteries contain about a fifth part, and the veins the remaining four *.

§. 14. From the blood all the different juices of the body are ſecreted, which for that purpoſe, and leſt it ſhould coagulate and corrupt by ſtagnation, is in perpetual motion throughout every part of the body. With this progreſſive motion and the manner in which it was performed the ancients were unacquainted; the honour of the diſcovery was reſerved for our countryman, the great, the im-

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* Halleri Elementa Phyſiologiæ, §. CLXVII.

mortal Dr. Harvey, who about the year 1619, firſt made public and explained this important doctrine: from his demonſtrations it was plain that an animal body was an hydraulic machine, all whoſe offices are entirely dependant upon the circulation of the blood, which cannot for any time (even a few minutes only) be ſuppreſſed without its neceſſary and conſequent deſtruction.

§. 15. The blood in its progreſſive motion is conveyed from the heart by the arteries, to all, even the minuteſt parts of the body; from thence being brought back again by the veins, and collected in the ſinus venoſus, it is protruded into the right or ſuperior auricle and ventricle; from the right ventricle of the heart it is forced into the pulmonary artery, and after circulating through, and being acted upon by the lungs in its paſſage through them, is returned by the pulmonary vein into the left or inferior auricle and ventricle; from the left ventricle it is expelled into the aorta, by whoſe converging branches it is tranſported into all parts of the body, and at length being tranſmitted from the extremities of the ſmall arteries into the naſcent or incipient veins, thro' them paſſes into their larger branches, till it arrives at their termination, the heart, from whence it is as before diſcharged into the arterial ſyſtem, again in a perpetual round, to traverſe the body.

§. 16. It has been diſputed amongſt authors, to what cauſes the alternate contractions and relaxations of the heart could be owing, and by what powers the blood with an inceſſant motion is circulated through the body: their hypotheſes have been very different and vague, not to ſay ſome of them very abſurd, till the learned and ingenious Dr. Whytt of Edinburgh, ſome few years ſince favoured the world with a ſatiſfactory theory on that head, founded upon experiment and ſupported by reaſon, which fully anſwers to, and explains all the phænomena of the heart's motion, upon principles as ſimple as they are agreeable to the known laws of the animal œconomy *.

The doctor, after premiſing ſome facts concerning the actions of the

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* Whytt's Eſſay on the vital and involuntary motions.

muſcles, and their proneneſs to contraction, from a ſtimulus, or any thing which will irritate, being applied to them, accounts for the contraction or ſyſtole of the heart, from the ſtimulus applied to, and the diſtenſion of this hollow muſcle, by the venous blood returning into the cavæ from the different parts of the body; and this he proves to be extremely well fitted to act in this manner upon the heart, from its compoſition, heat, inteſtine motion, the qualities it may probably receive from the air, and the force with which it ruſhes into its cavities.

From the irritation then communicated to the ventricles of the heart, and the diſtention of it's cavities by the blood, each of which may under particular circumſtances promote and influence its contraction, we may eaſily account for the conſtant and reiterated motions of this organ; and this of all the theories that have been hitherto offered, will beſt explain the ſeveral phænomena of the heart's action, and indeed appears in all reſpects ſatisfactory and concluſive. "Whilſt ſome authors "(ſays the doctor) have aſcribed the "contraction of the heart ſolely to the "blood, conſidered as a ſtimulating "fluid, which irritates the internal ſur-"face of its ventricles; others have "been unwilling to allow that the blood "acts in any other ſenſe as a ſtimulus "upon the heart, than as by its weight "and impulſive force it ſtretches and

“ diſtracts the fibres compoſing its ventricles; but the increaſed motion of “ the blood from the contagion of the “ ſmall pox, meaſles, and the like, “ and after eating and drinking any “ thing acrid, as well as the power “ which acrid and ſtimulating things “ have in renewing the heart's motion “ after it is ſeparated from the body, “ are circumſtances which ſhew that “ the contraction of the heart is not “ ſolely owing to its fibres being diſtracted by the movement of the blood, “ but partly to the irritation communicated to its internal ſurface by the “ particles of this fluid. On the other “ hand, the increaſe of the heart's motion from exerciſe, or from any other “ cauſe whence the blood is returned “ in greater quantity and with more "force to the heart, its diminution by "blood-letting, the phenomena of the "motion of the ſtomach, and of the "expulſion of the urine and fæces; all "theſe particulars prove, that even the "diſtention of hollow muſcles has a "remarkable influence towards exciting them into action."

It will appear then, that the blood returning by the cavæ and pulmonary veins, and ruſhing into the cavities of the heart, will in ſuch manner ſtimulate and affect its ſenſible nerves and fibres, as to bring it immediately into contraction: if the blood ſhould by any means have been rendered acrid, as from infectious miaſmata, an impeded excretion of the acrimonious perſpirable particles,

ticles, an abſorb'd purulent matter, or the like, by its increaſed ſtimulus it will excite the heart to quicker vibrations, and febrile ſymptoms muſt come on. Or again, by heat or exerciſe of the body, which rarify the blood, and cauſe it to be determined more copiouſly to the heart; the cavities being diſtended, its contractions will be more frequently repeated, and the contained fluids expelled with more force, and circulated with an increaſed velocity thro' the body.

§. 17. The ſyſtole, or contraction of the heart, is immediately followed by its relaxation or diaſtole; for the ventricles by their action having expelled the blood which they contained into the aorta and pulmonary arteries, their component fibres will neceſſarily loſe that tenſion and firmneſs which the moment before they were poſſeſſed of. At this time the contraction of the arteries begins; for the blood being expelled from the heart with a force which conſiderably exceeds the reſiſtance they can yield, will dilate them, diſtract their fibres, and perhaps ſlightly ſtimulate their internal ſuperficies: this their dilatation, and the change from a leſs to that of a greater capacity thereby occaſioned, is called the pulſe, the diaſtole of which is an expanſion of the artery beyond its natural circumference.

The arteries thus diſtended and irritated by the ſtimulus of the forcibly impelled blood, from an inherent contractile power, which is natural and common to them, as conſiſting of circular elaſtic fibres, are immediately again conſtringed, and return to their former diameters, by expreſſing a quantity of blood into the venous ſyſtem, proportionable to that with which they had been dilated beyond their ordinary capacity; and the arteries by this means being diſingaged from the wave of blood emitted from the ventricles, the diſtention and ſtimulus thereby occaſioned will ceaſe, till they are again overſtretched by the blood protruded into them at each ſyſtole of the heart, in conſequence of which they are again excited to contract themſelves. And this alternate motion and contraction muſt continue whilſt life and the circulation of the blood endure.

From the above it will appear, that from the pulſe we ſhall be able with a good deal of certainty to form a proper judgment as to the true ſtate of the circulating powers: a full, ſtrong pulſe will denote that the blood abounds in the body, and that it is expelled in large quantities at each contraction of the heart, into the arterial ſyſtem: as on the contrary, a weak languid pulſe will evince that the blood does not exceed in quantity, nor is it circulated with too great an impetuoſity through the body. A quick and ſtrong pulſe will argue that there is a diſpoſition to a plethora, at the ſame time a ſtimulus, to excite to more repeated contractions the circulating powers; as a quick and weak pulſe will prove that there is rather a deficiency in the quantity and conſiſtence of the fluids; but at the ſame time a ſtimulating acrimony, or a diſpoſition to irritability in the ſolids themſelves, beyond the neceſſary bounds.

§. 18. The actions of the heart and blood-veſſels will variouſly affect the circulating fluids, as they are performed with a greater or leſſer degree of ſtrength and elaſticity. It is to theſe that we are indebted for the converſion of chyle into milk, and at length into blood; and this will vary in its denſity and principles, according to the ſtrength or weakneſs of the ſyſtem of the ſolids, and as the circulation is performed with more or leſs vigour. The ſtrong elaſtic veſſels act forcibly upon their contained fluids, whence a greater friction and attrition of the blood and veſſels againſt each other, an increaſed heat and diſſipation of the more watery particles, the craſſamentum is wrought up to a higher degree of denſity, and abounds in full proportion to the ſerous parts.

The blood and juices of people in ſuch a conſtitution become for this reaſon more denſe, compact, and viſcid, which will be manifeſted by examining the blood of a robuſt man who uſes much exerciſe, which always will appear of this kind.

Even in diſeaſes in which the vital actions are too much encreaſed, as in ardent fevers and inflammatory diſeaſes, the maſs of blood is ſoon rendered denſe and tenacious, and covered with a phlogiſtic lentor.

On the contrary, where the veſſels are too weak, and the circulation languid, the fluids of the body cannot be ſufficiently acted upon, or worked up to a due degree of denſity and a proper conſiſtence, whence the blood has the appearance of a diſſolved watery fluid, not ſufficiently prepared for the ſtrength and nouriſhment of the body, or the purpoſes of the animal œconomy, nor circulated with a force ſufficient to preſerve and maintain the vital heat. And hence ariſes a pituitous lentor in the ſerum, which under theſe circumſtances is not ſufficiently attenuated, or its particles divided; whence concretions in the veſſels, cachexies, leucophlegmatiæ, and innumerable other complaints. In diſeaſes likewiſe in which the vital actions are depreſſed, the pulſe is ſmall and weak, the heat of the body leſſened, and the texture of the blood diſſolved, with a ſuperabundant quantity of ſerum.

§. 19. To the circulation of the blood rightly and æquably performed, we are indebted for life, health, and at laſt a gradual decay or old age. But if by any means the blood in its rotatory motion ſhould be impeded or diſturbed, it will become the fruitful cauſe and mother of diſeaſes and death. So long as the blood and humours are circulated through the ducts and canals of the body, an animal will live; but no ſooner does the circulation ceaſe and become extinguiſhed, than death ſucceeds to life. If the circulation thro' every part ſhould be performed freely, æquably, moderately and agreeably, ſo long we remain ſound and healthy; but in every diſeaſe we find the circulation too much encreaſed, decreaſed, immoderate or unequal; and morbific cauſes are in a great meaſure productive of diſeaſes, by diſturbing and impeding the œconomy of the vital motions, and perverting the ſecretions and excretions.

§. 20. Thus far it hath been thought neceſſary to premiſe, that the ſucceeding doctrines of the effects and uſes of blood-letting may more readily be comprehended and underſtood.

OF THE GENERAL EFFECTS OF BLOOD-LETTING.

§. 21. THE circulating powers according to particular circumſtances will be variouſly affected by an evacuation of blood, as ſometimes in a plethora, where the veſſels are too much diſtended, a moderate blood-letting will tend greatly to promote the free and eaſy motion of the fluids. On the contrary, we know of no remedy that will ſo ſpeedily weaken the powers of nature and impetus of the circulation, and produce ſo immediate and univerſal a weakneſs. We ſhall be at no loſs to explain from the preceding obſervations in what manner theſe effects can be produced, at the ſame time may eſtabliſh the doctrine and uſes of blood-letting upon plain, eaſy, and indiſputable principles.

§. 22. The ventricles of the heart, it has been obſerved (§. 16.) are dilated and excited into contraction by the returning venous blood; and by the œconomy of the circulation, the quantity expelled into the arteries at each ſyſtole or contraction will bear an exact and conſtant proportion to that which enters into, and dilates the cavities in its diaſtole; and this will be greater or leſs, according as the blood more or leſs abounds in the body.

In proportion then as the circulating fluids are diminiſhed or evacuated, the quantity to be received by the heart in its diaſtole muſt be leſſened; in conſequence of which, the quantity to be diſtributed by the arteries to the different parts of the body muſt likewiſe be diminiſhed, and every artery will become leſs full and diſtended according to its ſize and capacity. Hence we find, that after a copious phlebotomy, the pulſe becomes ſofter and eaſier, and the heat, tenſion, and compreſſion of the ſeveral parts of the body equally remit in porportion to the evacuation which may have been made: hence likewiſe, as the reſiſtance to the contraction of the arteries is in part taken off, and the moles movenda leſſened, the remaining blood will be more readily ſubſervient to the impulſive force of the arteries, which now will contract themſelves more eaſily and readily, and haſten the circulation of their contained fluids. And this will be exemplified in diſeaſes from a plethora, where the arterial tubes are often ſo much diſtended as greatly to be impaired in their tone and elaſtic force; ſo that they become unable rightly to perform their contractions, or circulate the blood through the body; but no ſooner is the diſtending cauſe removed by a copious phlebotomy, than the veſſels recover their elaſticity; and by their free and eaſy contractions, puſh forwards the circulating humours, by which the progreſſive motion of the blood, and the ſeveral functions of the body, before oppreſſed and ſuffocated, are now again reſtored.

§. 23. Though blood-letting in a plethora, and under particular circumſtances, may contribute ſo greatly to reſtore the motion and action of the veſſels, when diſtended beyond their tone of contraction; yet on the contrary, it is of all others the moſt ſpeedy remedy to weaken and deſtroy the action and elaſticity of the veſſels, and to produce an immediate and univerſal weakneſs; for as the influx of the blood into the cavities of the heart appears to be the cauſe which excites it to action (§. 16.) it muſt follow, that when the vital fluid is exhauſted, the quantity to be returned to the heart will be leſſened: whence the ſtrength of its muſcular contraction will be impaired; the reaction of the arteries, now not ſufficiently diſtended, will be abated; the circulating powers will flag, and may be reduced to any degree at pleaſure.

§. 24. As bleeding weakens and deſtroys the action of the veſſels and organical parts, upon the ſame account it leſſens the heat of the body and the motion and impetus of the blood throughout the whole vaſcular ſyſtem: for as the friction and attrition of the fluids againſt the ſolids are a chief cauſe of heat in the living animal, which is conſtantly augmented as the motion of the humours through the veſſels is increaſed, and again will gradually decreaſe as the motion and impetus are leſſened; it is evident, that by evacuating and taking away the cauſe which would excite the heart to action, the force and ſtrength of its muſcular contraction may to any degree whatever be diminiſhed; nay, we can at pleaſure by blood-letting alone reduce ſo far the motion and impetus of the humours, and give ſo great a check to life and the circulation, when too impetuous or beyond meaſure excited in acute diſeaſes, as to induce a general languor, and by protracting the evacuation, can bring on a deliquium animi, or even death itſelf, by which both heat and motion will moſt effectually be ſtopped and ceaſe.

Galen has related a caſe of a young man who was ſo immediately relieved in an acute fever by a copious phlebotomy, that a perſon preſent exclaimed, "O homo jugulaſti febrim *." By experiment

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* Galen. Method. Medend.

periment it has likewiſe been demonſtrated, that by theſe means the circulating powers may to any degree be weakened. The ingenious Dr. Hales, by adapting glaſs tubes to the veſſels of living animals, could remark the height the blood, as propell'd by the force of the heart and arteries, would aſcend to in the tube: he obſerved, that in proportion as he evacuated the blood from the body, the actions of the arteries became gradually weaker, and the aſcent in the tube more and more leſſened, till at length the powers of life unable with a due degree of force to propel and puſh forwards the fluids, the animal of conſequence expired [*]. It will appear

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[†] Hæmiſtatics, Experiment 1, 2, &c.

then that by blood-letting, the action of the heart and arteries, the motion and impetus of the blood, and with them the heat of the body, may to any degree at pleaſure be diminiſhed.

§. 25. Let us next examine the effects of blood-letting upon the fluids; and theſe it will appear will be principally to attenuate and thin them, and this it may effect in a twofold manner: as 1ſt, from the change ſuperinduced upon the ſolids; and 2dly, from a diminution of the craſſamentum, the thickeſt and moſt elaborate part of the animal fluids. As the condition of the fluids in a great meaſure depends upon that of the ſolids, whether their actions are more or leſs excited (§. 18.)

it follows, that where the circulating powers are weakened, the blood muſt ſoon be rendered thinner, as it cannot be worked up to that degree of denſity conſequent to a ſtrong and vigorous circulation. Again, by an evacuation of the cruor or craſſamentum, the thickeſt and moſt conſummate part of our humours (§. 11.) many of the effects produced by blood-letting are to be accounted for, which we ſhould be at a loſs to explain from the depletion of the veſſels only; ſince from the aliments they may ſoon be again filled, and would be diſtended as much as before. But where the cruor ſuperabounds in the body, the blood will become too thick, its fibrous parts will bear too great a proportion to its ſerous, and it is with difficulty it can be circulated through the ſmaller veſſels; whence obſtructions, ſtagnations, compreſſions, an impediment to the exit of the blood from the arterial into the venal ſyſtem, ruptures of the veſſels, ſuffocation and death. But if we diminiſh the quantity of the maſs of blood, a conſiderable portion of the thicker parts will be evacuated, the remainder will be rendered more thin and ſerous, and readily circulated through the ſmaller veſſels; nor can the loſs of the cruor be immediately repaired from the aliments, as there will be required the repeated actions of the veſſels in innumerable circulations through the body.

§. 26. From what has been above obſerved, it will appear obvious what effects are neceſſarily conſequent to an evacuation of blood, and theſe can only be the following: in a plethora a moderate blood-letting muſt tend to deplete and free the veſſels and organical parts when over diſtended with a thick, denſe blood, by which means it promotes and encreaſes the circulation of the fluids, the eaſy, free contraction of the arteries, and the elaſticity of the veſſels, at the ſame time conduces to the attrition, attenuation and motion of the blood; hence reſtores the natural and ready exerciſe of the functions of the body, depraved by a ſuperabundant quantity of humours diſtending the veſſels and clogging the circulation, and by thoſe means relieves in many and various diſeaſes, and produces great changes in the animal œconomy.

Again, the ſame remedy will prove of all others the moſt ſpeedy and efficacious to weaken the action and elaſticity of the heart and arteries, and to lower the impetus of the circulation: hence in acute inflammatory diſeaſes, where the blood is too rapidly and impetuouſly propelled, will afford an immediate and ſpeedy relief; but if profuſely, injudiciouſly or unſeaſonably uſed, where there is neither a real plethora or encreaſed impetus of the circulation, by lowering the vis vitæ, will retard the cure of many diſeaſes, at the ſame time greatly relaxes the ſolids and leſſens the heat of the body, retards the circulation,

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tion, diminiſhes the ſtrength, diſſolves and thins the fluids, and produces leucophlegmatias, dropſies, and innumerable other evils; whence the body becomes weak, infirm, and cachectic.

§. 27. *Can blood-letting be of any ſervice in thoſe diſorders which immediately owe their origin to a fault, either in the ſolid or fluid parts, as conſidered abſolutely in themſelves?* It ſhould ſeem not: we cannot by its uſe add ſtrength to weakened or relaxed ſolids, or ſoften the fibres when they become too rigid; neither in diſeaſes from a vicious conſtitution of the humours, will the redundant or contaminated particles alone be expelled, as ſuch a proportion only of the morbid matter can be evacuated, as the quantity of blood drawn away bears to the whole maſs of humours: ſo that we can neither expect that the vitiated particles of our fluids alone can be removed, or that the ſolids when primarily diſeaſed will be reſtored by this evacuation: but from a view of its effects we may conclude, that blood-letting is principally to be recommended in thoſe caſes where the æquilibrium between the ſolids and fluids is deſtroyed by too great a quantity, or too denſe a conſiſtence of the blood impeding the due and regular action of the veſſels; or elſe where the actions of the ſolids being too much increaſed, and the circulating powers beyond proper bounds excited, pervert and deſtroy the ſeveral functions of the body.

§. 28. *Have we any certain criterion to judge when it may be proper to recommend the uſe of this evacuation?* The pulſe will be our beſt and ſureſt guide, if we attend to that, we may readily judge of the true ſtate of the circulating powers. In every diſeaſe where the pulſe is full, ſtrong, or tenſe, we may be ſure that blood-letting will be indicated, as it proves that there is either a real plethora or too encreaſed an impetus of the circulation. In ſome caſes we ſhould be cautious that we are not deceived by an impreſſed pulſe from an over-diſtention of the arteries, which, as it is a true ſign of a plethora, will be relieved, and the pulſe will immediately riſe from the evacuation. Again, in old people, where the circulation is not too much increaſed, the pulſe will frequently be hard and tenſe, from a rigidity of the coats of the arteries, not to be removed by blood-letting. For the moſt part however we ſhall not eaſily err if we attend to the pulſe, which, if either full or tenſe, will indicate that the lancet may be advantageouſly recommended. But if the pulſe ſhould be neither full, ſtrong, or oppreſſed, it will plainly prove that the veſſels are by no means over-diſtended, or the circulating powers beyond meaſure excited: why then ſhould we evacuate where the fluids do not too much abound? or why ſhould we ſink the pulſe and leſſen the action of the heart and arteries, when they were not before too much increaſed.

§. 29. *Are we to attribute any particular effects to the revulſive or derivative blood-lettings ſo much practiſed and recommended by the ancients?* The ancients were greatly miſtaken, and differed much from the moderns in their theories of the blood; nor are we to wonder that their doctrines ſhould be erroneous, and built upon a wrong foundation, as wanting our later diſcoveries to aſcertain and rectify their phyſiological conjectures. Being ignorant of the functions and offices of ſome of the principal viſcera, of the circulation of the blood, and action and uſes of the heart and arteries, we ſhall not be ſurpriſed to find them guilty of many abſurdities in their theory and practice of blood-letting. Accordingly it appears that they were very ſuperſtitious in their election of veſſels, as they ſuppoſed that there was an attraction of the maſs of blood towards the orifice in blood-letting; hence allotted to every part its particular vein, which they imagined muſt communicate with it, and which it would have been the higheſt mal-practice not to have opened whenever it ſhould be diſeaſed. When the head was affected, the upper or external vein of the arm, thence termed the cephalic, was to be opened; when the noble parts or viſcera were diſeaſed, the internal, thence called the baſilic, was choſen; and if it ſhould have appeared neceſſary to bleed for the relief of both together, the vena mediana, which they ſuppoſed to communicate with each, was then the veſſel that was fixed upon, and ſo on of the others. And this their practice ſeems to have given riſe to the noted doctrine of revulſion and derivation, which for ſo many ages has prevailed amongſt the practitioners of medicine, and laid the foundation for numerous and almoſt endleſs diſputes. As our foreſathers were ignorant of the circulation of the blood, and had not the advantages from anatomy and natural philoſophy as are at preſent enjoyed; well might their theories and reaſonings be abſurd and whimſical, but it is matter of ſurprize, that the effects of revulſive or derivative blood-lettings ſhould not yet have been aſcertained by our modern phyſicians, or the queſtion decided, whether or no it is material from what vein or part of the body our evacuation ſhould be made in different diſeaſes. It is foreign to my purpoſe to enter into the diſpute, or take notice of the arguments in favour of revulſion, derivation, or both, ſince it ſeems moſt probable that the effects which they attribute to their revulſive or derivative blood-lettings, are entirely owing to the evacuation alone, and upon that principle may be ſatisfactorily explained, without regard to the part or vein it is made from; as where there are real indications for the evacuation, it is not at all material from whence it may be made: on the contrary, if the veſſels are neither too full, nor the circulation too much excited from what part ſoever we may draw blood, we ſhall rather do harm than good.

§. 30. *Is there any determined quantity of blood neceſſary to be drawn off in particular diſeaſes?* This depends entirely upon the habit, ſtrength and conſtitution of body, and the urgency of the ſymptoms; a great diſeaſe requires a great remedy. The pulſe and mitigation of the ſymptoms will however generally prove ſufficient, and our beſt guides; when theſe are properly reduced and brought to due bounds, we may be pretty well aſſured that this remedy has been ſufficiently inſiſted upon; ſometimes a few ounces may ſuffice, at other times ſome pounds may be required to anſwer a proper indication, though for the moſt part it may not be amiſs to ſtop rather ſhort as to quantity, than too much to protract the evacuation; as we can eaſily repeat the operation, and have it at any time in our power to ſink the pulſe, when it will not always be in our power to raiſe it again.

§. 31. *Are frequent blood-lettings without an apparent reaſon neceſſary for the preſervation of health or prevention of diſeaſes?* It is a common practice with many to accuſtom themſelves to bleed once or twice in a year, with an intention of confirming their health and preventing diſeaſes; but certainly they are often miſtaken in their views, and more frequently prejudice than benefit themſelves thereby. By obſervation we are taught that thoſe who have been accuſtomed to a loſs of blood, provided it be not ſo profuſe as too much to weaken the body, will the ſooner be again liable to an overfullneſs, though their habit of body will become conſiderably more relaxed. Women by the laws of nature ſuffer a monthly evacuation of blood, and monthly are they again filled and diſpoſed for the diſcharge. Men who have accuſtomed themſelves to repeated blood-lettings about the uſual time, will labour under nearly the ſame complaints as women from obſtructed menſes, till at length their natural robuſtneſs will degenerate into female delicacy. Hence as cuſtom may be compared to a ſecond nature, they will be obliged to continue the evacuation till they may conſiderably weaken and impair the conſtitution, and render themſelves obnoxious to many and various diſeaſes. However, if there ſhould appear to be real cauſes for the evacuation, it muſt be complied with, although it were certainly better not to repeat it upon every trifling occaſion.

From what has been above premiſed as to the effects of blood-letting, it will be plain what are the intentions of cure it will anſwer, and under what circumſtances its uſe can be required. We proceed to the doctrine of a plethora and inflammation, thoſe morbid affections in which it is moſt immediately uſeful.

OF A

PLETHORA.

FROM a view of the general effects of blood-letting, we are led to the particular indications in which it can be required; and theſe it will appear can be only twofold, as firſt in the diſeaſes from a true plethora where the veſſels are overfilled with a thick denſe blood; or ſecondly, in thoſe affections where the impetus of the circulation is beyond due bounds excited, as is for the moſt part the caſe in the acute fever and other inflammatory complaints.

§. 32. A plethora has been ſuppoſed to conſiſt in a preternatural fullneſs and diſtention of the ſanguineous veſſels, from ſo great and encreaſed a quantity of blood as will not ſuffer the machine to bear thoſe changes and accidents inevitable to life, without inducing diſeaſes, and thoſe of the moſt acute and dangerous kinds.

§. 33. This affection, which conſidered in itſelf is a manifeſt proof of a good conſtitution, generally happens to thoſe whoſe circulating powers, veſſels and viſcera are ſound and ſtrong, and their functions performed with vigour; eſpecially if a greater quantity of nutritious aliments ſhould have been indulged in than ſuffices for the nouriſhment of the body and the preſervation of life; or it may happen from a ſuppreſſion of a natural, or a neglect of an accuſtomed artificial evacuation of blood; ſince by obſervation we are taught, that cuſtom is a ſecond nature, and that thoſe who have been habituated to a diſcharge of blood about the uſual time, will labour under all the ſymptoms of too great a fullneſs.

§. 34. It has been believed that the phenomena in plethoric caſes ariſe from too great and encreaſed a quantity of the blood and juices in general; but from a more minute enquiry it will perhaps appear that this cannot be the caſe; ſince from the aliments the food and drink, the loſs of humours would be almoſt immediately repaired, and the veſſels repleted and diſtended as much as before; conſequently a new blood-letting muſt be again required, which it would be neceſſary to repeat as often as an encreaſed quantity of aliments ſhould be received into the body.

§. 35. It is much more probable that the phenomena in plethoric caſes are the conſequents of the fibrous craſſamentum, or thicker parts of the blood abounding in an over-proportion to the ſerous or thinner. From an exceſs in the quantity of the fibrous parts, the blood becoming too thick and denſe, can with difficulty be circulated through the ſmaller and minute veſſels, or propelled from the extremities of the arterial into the venous ſyſtem; whence a diſtention and dilatation of the arteries, an impediment to the free, eaſy, and ready circulation of the blood, an encreaſed reſiſtance to the force and action of the heart, ruptures of the veſſels, eſpecially in thoſe parts where they are moſt fine and tender, as in the brains and lungs, obſtructions, compreſſions, hæmorrhages, vertigo's, apoplexies, and even death itſelf.

§. 36. It will appear ſtill more manifeſt that the above is the moſt palpable conjecture, if we attend to the circumſtances previous to this affection, and remark the conſtitutions moſt obnoxious to it. It has ever been obſerved, that the moſt healthy and robuſt are the moſt liable to diſeaſes from a plethora; as here from the ſtrong and vigorous circulation and action of the ſolids upon the fluids, the blood will be thickened, and the craſſamentum will greatly abound. (§. 18.) On the contrary, in the weak and infirm, from the languid circulation, and debilitated action of the ſolids upon the fluids, the juices will not be duely elaborated, or worked up to a proper degree of denſity, the thinner parts will bear too great a proportion to the thicker; and though the veſſels may be ſufficiently full and diſtended with this thin and watery blood, yet it never happens that the diſeaſes from a real plethora are induced, or are their maladies to be relieved by blood letting.

§. 37. It ſhould ſeem then that the ſymptoms in a plethora will not depend ſo much upon an encreaſed quantity, as upon the quality of the fluids; a denſe rich blood will always prediſpoſe to plethoric affections, whilſt a thin and watery ſtate of the juices will be productive of diſeaſes of a very different and oppoſite kind. We may hence readily underſtand why other, though more plentiful, evacuations cannot always ſupply the place of blood-letting; why too great a loſs of blood, or rather of its craſſamentum, ſo much thins and attenuates the remaining maſs, and diminiſhes the heat and ſtrength of the body; and why an evacuation of blood becomes ſo prompt and ſpeedy a remedy in moſt diſeaſes which owe their origin to a true plethora, while on the contrary in a cacochymia, leucophlegmatia, or where the veſſels are filled and diſtended with crude and watery juices, it becomes not only uſeleſs but very injurious.

§. 38. The cure of a plethora will be obvious from its cauſes and effects; for ſince too denſe and rich a ſtate of the blood will prove the occaſion of the ſeveral ſymptoms in plethoric caſes, whatſoever can thin and attenuate the maſs of fluids and relax the ſolids, muſt prove beneficial: hence the beſt and quickeſt relief will enſue from a copious blood-letting, which almoſt immediately relieves and removes the cauſe. By this evacuation a conſiderable portion of the denſe craſſamentum being drawn off, the remainder will be rendered more thin and ſerous; (§. 25.) the action of the veſſels and circulation through the body will become regular and equable, by which means its ſeveral functions will be duely and properly performed, and health again reſtored.

§. 39. After blood-letting likewiſe the ſeveral ſecretions and excretions, as of blood, urine, ſweat, and the like, will ſucceed better and more freely in the plethoric than before; as from too denſe a ſtate of the blood, the extremities of the ſecreting and exhaling arteries will be obſtructed and compreſſed, and their ſeveral ſecretions retarded; but by depleting the veſſels, the circulation will be promoted, the blood will become more fluid and attenuated, and more freely and largely circulated thro' and about the different emunctories, to ſuffer a ſecretion. Hence in the menſtrual ſuppreſſions of plethoric women, by opening a vein the evacuation has ſoon after ſpontaneouſly returned; and hence in the inflammatory fever, a copious ſweat, not to be before excited, readily breaks out.

§. 40. The volatile alcaline ſalts have been ſuppoſed to be poſſeſſed of a property of diſſolving the craſſamentum of the blood; for which reaſon, after phlebotomy they may be of ſervice in plethoric caſes. Lenient purgatives, the neutral ſalts, and plenty of warm diluting liquors may likewiſe have their advantage. We may afterwards prevent a future plethora by a ſpare and moderate diet, exerciſe of body, and a proper regulation of the non-naturals; and ſhould gradually omit the uſe of accuſtomed artificial evacuations, that at length they may without danger be entirely left off, and the body continued in a ſound and healthy ſtate without their uſe.

OF

INFLAMMATION.

§. 41. WE proceed to the doctrine of inflammation, than which there is perhaps none of more avail to the practice of phyſick, or with which the phyſician ought to be better acquainted, as it comprehends the theory and general method of treatment of the greater part of our acute febrile diſeaſes, ſuch as pleuriſy, phrenſy, peripneumony, quinſey, and the like: theſe, as being owing to the ſame general cauſes, will require nearly the ſame cure; ſome little regard being at the ſame time had to the part affected, its functions and uſes. The doctrine of inflammation then, when explained and underſtood, will readily lead us to an acquaintance with the nature, cauſes, and cure of the inflammatory complaints of every kind ſo frequently to be met with in practice.

§. 42. An inflammation, phlegmone, or phlogoſis, ſo called from fire or heat, a principal and conſtant ſymptom, may be defined a reſplendent tumour of a red colour, hardly yielding to the preſſure of the finger, attended with an acute pungent throbbing pain, great heat and pulſation, and for the moſt part with a hard tenſe pulſe, an encreaſed circulation, a fever and its ſymptoms, ſuch as thirſt, heat, watchings, weakneſs, anxiety, and the like.

§. 43. It may attack any parts of the body, either the external or internal; but perhaps the cellular membranes are the moſt common and frequent, or indeed the only ſeat of the diſeaſe, though the cauſe may be infixed in an adjacent tendinous or membranous expanſion.

§. 44. A variety of opinions have prevailed, and authors have conſiderably varied from each other as to the proximate cauſes of inflammation. Boerhaave has ſuppoſed that it proceeds from a ſtagnation of the red arterial blood obſtructing the minute canals, and more firmly impacted by the preſſure and attrition of the remaining maſs, agitated by a concomitant fever *. Dr. Whytt

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* Aphoriſm, 371.

gives it as his opinion, that an inflammation is not owing to an encreaſed force of the heart and arteries conſequent upon an obſtruction, as ſome authors of great name have imagined, but to an encreaſed oſcillatory motion in the ſmall veſſels; whether this ariſes from ſome obſtructing matter diſtracting their fibres, or acrid matter irritating them. An obſtruction without an irritation in the obſtructed part, never occaſions an inflammation; but the irritation of any ſenſible part with a ſharp inſtrument or acrid matter, never fails to produce this effect, although there be no preceding obſtruction or increaſe of the heart's force *. Dr. Haller has

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* Whytt's Phyſiological Eſſays.

hinted, that it appears the moſt probable, that the greater part of our inflammations are not owing to blood impacted in the veſſels, but to its exſudation into the circumjacent cellular membranes; hence ſuppoſes that the cauſe of inflammation is entirely different from obſtruction, whether it may happen from a ſtimulus, or, as perhaps may be the caſe, the nature of this affection ſhould not as yet have been ſufficiently aſcertained *.

§. 45. With reſpect to theſe hypotheſes, we ſhall take the liberty to remark what in each appears moſt palpable, and how far they are liable to objection.

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* Haller. Element. Phyſiologiæ, tom I. pag. 115, 116.

The Boerhaavian doctrine of obſtruction, though it has been adopted for near forty years by the greater part of phyſicians throughout Europe, appears by no means ſufficient to account for the ſeveral phenomena of inflammation. It certainly is elegant, but devoid of a real foundation; nay, ſhould it even be granted to exiſt, will not ſuffice to explain the effects which have been attributed to it, as the conſequents of inflammation have in this caſe been always miſtaken for the cauſe. It has been ſuppoſed by the advocates for this doctrine, that an inflammation depended upon an obſtruction of the ſmaller ſerous arteries from the red globules of blood paſſing into, and being detained there: this they call an obſtruction from an error loci. Theſe veſſels, which they believed were conical, and in a natural ſtate conveyed the ſerous and thinner particles of the fluids only, might from different cauſes ſo far ſuffer a diſtraction at their origin, as to admit the red globules of blood into their dilated orifices; but at the ſame time would oppoſe a reſiſtance to their progreſs as they were propelled forwards, and ſtill more as they advanced towards the extremities of the veſſels; whilſt the blood circulating in the adjacent arteries, being by the action of the heart and arteries continually urged forwards upon the obſtructing particles, they by theſe means become ſtill more firmly impacted in the ſtraitened paſſage. And hence they would account for the cauſe and ſigns of inflammation. The minute, pellucid, and ſcarce viſible arteries becoming obſtructed, are by the diſtending blood enlarged and rendered viſible, and give riſe to the red tumour. The veſſels over-diſtended and nearly burſt, will be the occaſion of the pungent pain; and from the irritated fibres and quickened circulation thro' the pervious veſſels, the pulſe becomes more frequent, a fever comes on, with thirſt, heat, weakneſs, watchings, and and the like. And unleſs the obſtructing matter ſhould be repelled from the minute ſerous into the ſanguineous arteries, or be ſeparated into ſmaller moleculæ; ſo that they might paſs thro' the extremities of the veſſels, the over-diſtended canals would at length neceſſarily burſt, as there could other-wiſe be no exit to the obſtructing globules.

As they believed that a red globule was compoſed of ſix ſerous united, and a ſerous globule of ſix lymphatic, ſo they have further ſuppoſed that in the ſame manner as the ſerous veſſels ariſe from the minute ſanguineous, other finer veſſels were branching off from the ſerous, neither was there yet a ſtop to the progreſſion, or was the ultimate claſs of veſſels known.

And hence they have ſtill further imagined, that new errores loci, and inflammations which would not appear of a red, but of a yellow colour, might ariſe as often as the yellow fluid of the ſerous arteries was impelled into the pellucid lymphatic veſſels and detained there; whence eryſipelatous inflammations and various other affections.

It remains that we examine how far the above elegant and ſpecious theory will be found true.

That there are veſſels which naturally do not appear to circulate the red blood, no one can deny; for of this the fabric of the eye alone affords ſufficient proof: but it does not follow that they can become obſtructed from an error loci, ſince it is certain that the principal argument on which this theory is founded is deſtitute of a true foundation: for as Dr. Haller has obſerved, although theſe veſſels which are naturally pellucid and indiſcernible, when injected with a tinged liquid, or over diſtended with blood, will appear red and become conſpicuous, it does not amount to a proof that they were before impervious to the red globules, or that they are of a different kind to the red ſanguineous; ſince it has been remarked by ſeveral ingenious phyſiologiſts, that the minute veſſels will appear pellucid, even though they may contain the red blood, as the globules will appear pale when ſolitary in a veſſel pervious to one ſeries only *.

Nor does it appear that the blood in inflammatory caſes is impacted in the veſſels only, but circumfuſed into the adjacent cellular cavities; ſince if we examine the redneſs of an inflamed finger

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* Halleri Elementa Phyſiologiæ, Pag. 115.

or membrane, the veſſels do not appear in ſuch wiſe interſperſed about the part that colourleſs ſpaces intercede between them, as is the caſe in the eye when irritated; on the contrary, a part inflamed is equably and entirely reddened. Beſides, it is repugnant to obſervation, that an inflammation ſhould ſucceed to an obſtruction: an obſtruction in a veſſel is a good deal analogous to a ligature, which would impede the free paſſage of the fluids. But neither obſtruction or a ligature have of themſelves been productive of inflammation. When the larger arteries have been tied, the umbilical in the new-born fœtus, or the carotid, or any other trunk in the living animal, no inflammation has enſued; after a few pulſations and a tumour ſuddenly coming on, the blood dilates and circulates through the collateral branches of the artery, and the empty trunk itſelf collapſes, and its ſides concrete. In the ſmall and pellucid veſſels, in which by the microſcope we can detect what is paſſing, Dr. Haller has obſerved, that a ligature applied has an effect quite contrary to the received opinion * ; for the obſtructed canals are ſo far from being diſtended, that the blood avoids the ligature and the impervious branch, and betakes itſelf into the communicating arteries, till that which has been tied is left entirely empty. He has likewiſe had frequent occaſion to obſerve that obſtructions have been formed in the ſmall veſſels of the liv-

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* Second Memoire ſur le Mouvement du Sang, Exp. 54, 93.

ing animal, which were not productive of any ill effects.

We may add, that as the cellular membranes are generally allowed to be the ſeat of inflammation, it will ſcarcely ſeem probable that the veſſels interſperſed in theſe fine thin membranes can ſuffer ſo great a dilatation, or receive into their cavities ſuch a quantity of blood as would be requiſite to conſtitute the inflammatory tumor; and as it has been proved that the motion of the blood through the minute veſſels is extremely languid, and in a good meaſure depends upon the little oſcillatory contractions of the veſſels themſelves *, the effects which Boer-

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* Whytt's Phyſiological Eſſays.

haave has aſſigned as conſequent upon the circulating blood urged forwards with force upon the obſtructed veſſels, muſt of courſe be void, and without foundation: his whole doctrine likewiſe of inflammation, as founded upon obſtruction, muſt be deficient; as there muſt have been a cauſe for the inflammatory obſtruction, and this can only happen from irritation: granting then that obſtruction might occaſion an inflammation, it muſt have been the cauſe of the obſtruction, viz. the irritation that would have been productive of the inflammation, and the obſtruction would only have been a conſequence, but by no means the cauſe of the diſeaſe.

Dr. Whytt's theory of inflammation is much more ſatisfactory than the Boerhaavian; and he is moſt certainly right when he attributes to an encreaſed oſcillatory motion of the ſmaller veſſels, excited by a ſtimulus or irritation, the cauſe of inflammation; but it may be doubted, (or indeed, from what has been above obſerved as to the doctrine of obſtruction, it will rather appear improbable) whether the effects he has aſſigned will be found ſufficient, when he ſuppoſes that in conſequence of the encreaſed contractions of the veſſels, the part will be inflated, and globules of red blood forced into the ſerous veſſels, i. e. an inflammation muſt be produced.

Will it not appear much more probable, that, agreeable to Haller's obſervations, an effuſion of blood into the cellular membranes from the extremities of the arteries, which exhale into their cavities, will be brought on by the unuſual irritation; and this of all other hypotheſes hitherto advanced, ſhould ſeem to be the leaſt liable to exception, as it beſt accounts for the ſeveral appearances in inflammatory diſeaſes.

From the dilatation of the veſſels, and repletion and diſtenſion of the cellular follicles, the tenſe, reſplendent, red tumour, even Boerhaave himſelf, and his commentator Van Swieten, are obliged to allow that the red blood paſſing into the cellular membranes, is a cauſe of the tumour in even conſiderable inflammation,

tion, as the parts could not be ſo greatly enlarged from an obſtruction and diſtenſion of the veſſels only *. The acute pungent pain will depend upon the irritation of the nervous fibrillæ, and the diſtenſion, compreſſion, and dilatation of the veſſels. The pulſation will be owing to the ſtronger encreaſed and quickened contraction of the veſſels, and the burning heat to this and the conſequent accelerated motion and friction of the fluids; the tenſe pulſe, quickened and ſtronger circulation, and the like, to the increaſed irritability of the heart and vaſcular ſyſtem, and the nervous influence too much determined to the circulating powers.

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* Comment. in Aphoriſm. 382.

§. 46. It ſhould appear then that no inflammation can ſubſiſt without a preceding or concomitant irritation, which alone will always prove ſufficient to produce it; as a thorn lodged in the finger, or a little acrid matter collected below the nail, will frequently bring on a violent inflammation, extending even to the ſhoulder. By the unuſual ſtimulus the oſcillatory contractions of the ſmaller veſſels muſt neceſſarily be augmented and excited, and a greater quantity of fluids in a given time muſt circulate through them: hence from the ſtronger and more frequently repeated contractions, the force of the blood in the irritated veſſels will be greatly increaſed, the veſſels themſelves dilated and diſtended, and thoſe whoſe orifices open into the cells of the adipoſe or follicular membranes, and naturally exhale a thin fluid only, will now ſuffer the red blood to paſs or exſude through their extremities into the cellular cavities. That this has been the caſe is evinced from obſervation and αυτοπσια, as Dr. Haller, in different inflammatory affections which he has had an opportunity of examining after the deceaſe of the patient, has found that the blood has been extravaſated into the cellular membranes *.

§. 47. An encreaſed force of the blood in the larger veſſels does not then ſeem neceſſary to conſtitute an inflammation, yet it is moſt frequently the conſequence of it; for as often as the inflammation is any thing conſiderable, or the part

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* Opuſcul. Pathologica Obſ.

inflamed very ſenſible, the whole nervous ſyſtem will be ſo affected by the pain as to render the heart and larger arteries more irritable, and their contractions more frequent and ſtrong, whence an encreaſed circulation and fever.

§. 48. The cauſes of inflammation may be various according as the diſeaſe ſhould be of the external or internal kind. Any thing which is capable of producing an irritation, and exciting the contractile powers of the veſſels, may give occaſion to an affection of this kind; hence frictions, burns, a foreign ſubſtance lodged in the fleſh, ſtimulating, irritating applications, and the like, may readily be productive of theſe complaints. But as theſe cannot often ſubſiſt in the internal parts and viſcera of the body, but are principally confined to the external or extreme parts, we muſt have recourſe to ſome other principle to explain the cauſes of our internal, inflammatory, and other acute febrile diſeaſes. Theſe then for the moſt part will derive their origin from cold: our patients themſelves generally remember that they have been expoſed to cold, and blame this as the primary cauſe of their diſeaſe.

§. 49. The excretion by the ſkin, or inſenſible perſpiration, is the laſt and moſt elaborate action of animal digeſtion, and frees the body from what is conſequently the moſt ſubtile, acrimonious, and putreſcent of the animal humours.

mours. It is of the higheſt concern to the life and well-being of the animal machine; and though it may be excreted, ſometimes in a greater, ſometimes in a leſſer quantity, as influenced by various cauſes, yet it can never long be partially ſuppreſſed, much leſs entirely obſtructed, without the greateſt detriment to health, and exciting various diſorders in the animal oeconomy, ſuch as catarrhs, rheumatiſms, fevers, inflammations, and innumerable other complaints; as from the ſtimulating acrimony of the excrementitious humours, the circulating powers will be variouſly diſturbed and affected, and the veſſels excited to ſtronger and more frequently repeated contractions. It ſhould ſeem then that the inflammations of the internal parts will depend upon the irritation and conſequent encreaſed and quickened contractions of the veſſels, from a retention of the acrimonious perſpirable particles, determined to and infixed in ſome particular viſcus or membranous part. Thus much however we may venture to aſſert, that though we may not be perfectly acquainted with the ſecret operations of nature in the formation of diſeaſes, if we attend to experience and obſervation, we ſhall find that our inflammatory complaints are originally owing to cold; and from this principle, and this only, conſidered as the primary cauſe of the diſeaſe, can the ſeveral phenomena preceding and concomitant to internal inflammation be explained and underſtood.

§. 50. An inflammatory tumor cannot long continue in its ſtate of inflammation, but muſt within a few days be terminated either by reſolution, ſuppuration, or gangrene. Boerhaave and his followers have ſuppoſed that it may ſometimes be ſucceeded by ſchirrus; but it may be doubted whether a ſchirrus is ever the conſequence of inflammation, perhaps experience will not warrant it.

§. 51. An inflammation is reſolved when the irritating cauſe being expelled or ſubdued, the encreaſed flow of humours ceaſes, the effuſed fluids are abſorbed, the diſtended veſſels relaxed, and the circulation through the part becomes regular and equable as before.

§. 52. An inflammation terminates by ſuppuration, when from an encreaſe of the ſymptoms the abſorption of the effuſed fluid is impeded, which by its ſtagnation will be changed from its natural ſtate, and, together with the cells and their contents, will be diſſolved and converted into an homogeneous humour, known by the name of pus.

§. 53. An inflammation is ſucceeded by gangrene when the maſs of fluids in general are tainted with a putreſcent acrimony, or the affected part itſelf, ſuch as the inteſtines, or the like, from their peculiar nature prone to putrefaction. The irritability of the ſolids in general will under theſe circumſtances be almoſt immediately deſtroyed, the circulation through the part affected will ceaſe, the effuſed liquors putrefy, the red colour is changed to a livid or blackiſh hue; the pain, heat, and pulſation are abated; the pulſe becomes weak, languid, and ſcarce perceptible, till at length the circulating powers being no longer able to propel the humours, inevitable death muſt cloſe the ſcene.

§. 54. From what has been obſerved of the ſeveral events of inflammation, we ſhall readily determine which of them is the moſt eligible and to be wiſhed for; and that its reſolution, eſpecially when it happens to an internal part, is by all means to be attempted, as being the ſafeſt, and attended with leaſt trouble, danger, and difficulty.

§. 55. That we may procure a reſolution of inflammation, our attempt ſhould be directed to reduce to proper bounds the febrile impetus, to remove and enervate the cauſe of the diſeaſe, and allay the encreaſed oſcillatory contractions of the veſſels.

§. 56. Every fever is its own cure, all that art can do is properly to regulate the febrile impetus, and provide for the relief of the ſymptoms: as an inflammation is a partial fever, we ſhall find that when the cauſe is removed, the powers of nature rightly moderated will ſuffice for its own cure: but as in general the patient is plethoric, and the actions of the veſſels and impetus of the circulation are greatly encreaſed in all diſeaſes of this kind; and as by theſe means, from the too rapid motion of the fluids and diſtention of the veſſels, the regular ſecretions and excretions cannot be given off, nor the extravaſated fluids abſorbed, it will be found an affair of the higheſt importance to reduce to proper bounds the circulating powers by plentiful and repeated blood-lettings, and other evacuations. And as the moſt healthy and robuſt, whoſe fluids are denſe and ſizey, and ſolids ſtrong and elaſtic, are the moſt liable to inflammatory diſeaſes; blood-letting will certainly be the firſt intention for the relief of thoſe ſymptoms that depend upon a circulation too much excited, and a contractile ſtate of the veſſels too much encreaſed: by this evacuation the quantity of the arterial blood being diminiſhed, the veſſels will become leſs diſtended, at the ſame time are relaxed and their action weakened, the blood itſelf will be leſs compreſſed and more thinned, and its denſity and inflammatory diatheſis reſolved; the fever will be abated, the impetus of the circulation diminiſhed, and the powers of life and nature weakened and rendered leſs active: hence neceſſarily as the circulation becomes more moderate and regular, an abſorption will be more readily made by the depleted and leſs contracted veſſels, and both the general and partial fever will greatly abate. As to the quantity of blood to be drawn, it depends principally upon the ſtrength and conſtitution of the patient and violence of the diſeaſe; but if we attend duely to the pulſe and circulating powers, we ſhall not often err; whilſt this continues hard, tenſe, and full, we may evacuate to advantage; but if ſoft, weak, or low, we muſt deſiſt from a further evacuation.

§. 57. But though blood-letting promiſes to be ſo immediate an aſſiſtance for the relief of the ſymptoms in incipient inflammatory diſeaſes, we may obſerve that it is not ſo in their advanced ſtate, and perhaps after the fourth or fifth day is rather detrimental than ſerviceable; for the extravaſated fluids, by their ſtagnation, and perhaps by a ſlight putrefaction, being altered from their natural, and tending to a purulent ſtate, a reſolution will not be obtained; and now it only remains that by a mild ſuppuration the inflamed parts may be ſeparated from the ſound, and this event of inflammation, a fever, and that frequently a ſmart one attends, whoſe impetus ought not to be leſſened, at leaſt by large and repeated bleedings: but even here, if the fever ſhould run too high, with great heat, and a pulſe full and ſtrong, a moderate blood-letting will prove rather uſeful than diſſerviceable to promote the ſuppuration: in general we may lay it down as a rule, that in all inflammatory caſes if the pulſe ſhould be tenſe and full, we ſhall not eaſily err or do miſchief; but on the contrary, greatly benefit the patient by a moderate blood-letting.

§. 58. Though a prudent and proper uſe of the lancet appears to be ſo efficacious and neceſſary in the cure of inflammatory diſeaſes, we are by no means to neglect other aſſiſtances; lenient purgatives will frequently be found greatly uſeful; ſuch are infuſions of ſenna and rhubarb, ſolutions of manna, the cathartic ſalts, cremor tartar, and the like; theſe may be a means of fuſing and evacuating the humours, and gently diverting their impetus to the inteſtines. But of all other remedies, the preparations of antimony after blood-letting will claim the preference. By theſe the primary cauſe of the diſeaſe, the obſtructed perſpiration may be overcome, and the excretion reſtored, which is an intention of conſequence in the cure of inflammation.

§. 59. As our inflammatory febrile complaints are owing to cold, it ſhould ſeem that if we could promote a perſpiration, and excite a gentle diaphoreſis, without heating the body or increaſing the fever, it muſt be the moſt ready and rational manner of relieving the patient, and experience indeed evinces the ſucceſs of this method of treatment; but our beſt and almoſt only remedies for this purpoſe are prepared from antimony; with theſe we can with a good deal of certainty promote the excretion from the ſeveral outlets. The emetic tartar, which is as good as any of the preparations, may be given, from half a grain to two grains, with a little of the calx of antimony to encreaſe its bulk, in thin ſyrup, or the like, at the diſtance of twenty-four hours for two or three times. Or we may prepare a powder from the regulus crocus or glaſs of antimony;

timony; either of theſe in very fine powder being well mixed with an equal quantity of pulverized nitre, ſhould be injected by a ſpoonful at a time into a red-hot crucible; let it be continued in fuſion for about twenty minutes after the detonation ceaſes, when it may be removed from the fire, ſhould be well waſhed with warm water and finely powdered. It may be given from eight grains to forty. If to half a dram of this powder we add gr. ij. of mercurius corallinus, we ſhall have a medicine not to be diſtinguiſhed in ſmell, taſte, or operation from the powder which has lately made ſo much noiſe in the cure of fevers, and for which Dr. James has procured his majeſty's letters patent. The practice of phyſick in fevers is moſt certainly improved by the introduction of the reguline preparations; and though Dr. James is by no means the firſt who uſed and recommended them as a febrifuge, it muſt be owned that their good effects have been more generally known, and the medicine itſelf brought more into eſteem from the good ſucceſs which has attended the uſe of his preparation. And indeed it will readily appear, that after blood-letting they bid the faireſt of any medicine to relieve in every internal inflammatory affection; as by their gently ſtimulating qualities they will promote the ſeveral excretions, puke once or twice, frequently procure a ſtool, and almoſt always excite a copious ſweat without heating the body or encreaſing the fever.

ver. We ſhould obſerve that their uſe ought principally to be confined to the firſt days of the illneſs, as perhaps after the fourth day they will be rather prejudicial than uſeful; for the retained perſpirable particles being changed by their remora in the body, can only be expelled by proper coction and criſis; hence by exciting the evacuations by vomit and ſtool, we ſhould rather fatigue and weaken, than benefit the patient, as the morbific matter will rarely be expelled at this ſtage of the diſeaſe. Sometimes indeed it may happen, that at the latter end, or after a proper coction of the morbid fomes, if the patient has ſtrength to bear the operation, by promoting the ſeveral excretions it may tend to bring on a criſis and haſten the removal of the diſeaſe.

§. 60. Diluting antiphlogiſtic liquors ſhould be plentifully taken, ſuch as barley-water, a decoction of apples, lemonade, watergruel, thin weak whey, and the like.

§. 61. The common ſaline draught with nitre may generally be given to advantage; but as the pulſe becomes lower the nitre ſhould be omitted, and twelve or fourteen grains of ſalt of hartſhorn ſubſtituted in its room; or towards the latter end of the diſeaſe, if the pulſe ſhould flag, as is frequently the caſe, to the ſal. corn. cerv. may be added the warm aromatic cordials. The neutral ſalts we may obſerve, will frequently excite a ſweat, and this perhaps by a gentle ſtimulus upon the vaſcular ſyſtem; but if they ſhould not ſufficiently of themſelves tend to promote this diſcharge, we may for the moſt part effectually anſwer the intention by adding to each doſe thirty or forty drops of the ipecacoanha wine, which, as an attenuant and ſudorific, is a medicine that is exceeded by few.

§. 62. It may appear contradictory to preſcribe the volatile alcaline ſalts in a diſeaſe where the circulation is already too rapid, and the vis vitæ too much excited; but after the pulſe has been lowered, they will well tend to reſolve the inflammation. Dr. Huxham ſuppoſes *, that the volatile ſalts and ſpirits

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* Diſſertation on the malignant ulcerous ſore throat.

haſten the diſſolution of the blood whilſt under the power of the circulation, and even when mixed with the blood out of the body, or rather as it runs from the vein; they quite deſtroy the texture of its globules, by diſſolving the copula or coheſion of its component particles; even the moſt ſizey blood thus managed never concretes into a ſolid craſſamentum, and throws off its ſerum, but remains ever after a looſe diſſolved gore or ſanies; nor does he think that the volatile alcaline ſalts heat the body, by encreaſing the projectile force and circulation, ſo much as by cauſing an inteſtine motion and efferveſcence in the blood; for by the moſt accurate experiments it is found, that ſolutions of the volatile alcaline ſalts weaken the tone of the fibres and power of the veſſels; conſequently the momentum of the blood in the regular courſe of circulation. Since then the people of plethoric habits, with ſtrong and rigid ſolids, and a denſe ſizey ſtate of the fluids are by far the moſt ſubject to inflammatory indiſpoſitions, will it not follow, that after a prudent uſe of evacuations, ſalt of hartſhorn would bid fair to diſſolve the inflammatory gluten, as well as to weaken the tone of the ſolids, and leſſen the momentum of the blood in the courſe of the circulation. Experience at leaſt evinces the ſalutary effects of a prudent and well timed uſe of this remedy in moſt inflammatory diſeaſes.

§. 63. But whilſt we are inſiſting upon internal remedies, topical applications to the part affected are by no means to be neglected; hence a particular regard is to be had to the veſſels of the diſeaſed part, whoſe extraordinary contraction ſhould be leſſened by proper emollient and anodyne applications, fomentations, cataplaſms, and the like; and in many caſes by bliſtering the neighbouring parts. Dr. Pringle has often obſerved the good effects of bliſters, even when early applied, in pleuriſies and other internal inflammations †; and though many phyſicians may have entertained prejudices againſt bliſtering in inflammations, becauſe by their irritation they encreaſe the force of the circulation in general; yet, not to mention the good effects they may have by attenuating the inflammatory matter, and making a conſiderable derivation of ſerous humours from veſſels which are nearly connected with thoſe of the part affected, if the account that has been given of inflammation be true, it muſt follow that although the material cauſe of an inflammation, the acrid or irritating cauſe, be not immediately removed by bliſtering, yet if, according to Hippocrates's obſervation, the painful ſenſation in the inflamed veſſels be leſſened by its means, the extraordinary oſcillatory motions of theſe veſſels, and conſequently the cauſe continuing and increaſing, the inflammation muſt be alſo leſſened: hence it appears that a bliſter, though it tends to encreaſe the force of the circulation in general, may yet leſſen the impetus of the blood upon the veſſels of an inflamed part, more remarkably than even blood-letting itſelf. What has been ſaid of bliſtering may be applied alſo to cupping and ſcarifying in pleuriſies, anginas, and the like.

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† Obſervations on the Diſeaſes of the Army.

§. 64. In general we may obſerve, that as our internal inflammations are reſolved in the ſame manner as in other fevers, there appears a ſenſible criſis: if as the ſymptoms abate, a ſweat ſhould break out, and the urine let fall a copious purulent-like ſediment, there is the greateſt probability of a ſpeedy relief; hence we ſhall find a great analogy between the partial and general fever, and the cure of the one will be greatly illuſtrated by that of the other.

§. 65. If the inflammation ſhould not be reſolved, but come forward to a ſuppuration, and the part affected cannot be come at, or the abſceſs laid open, and the ulcer deterged and healed, a variety of bad and dangerous ſymptoms will enſue, the confined pus will become acrid, irritate, and ulcerate, and a portion of it being abſorbed into the circulation by its ſtimulus will incite the heart and vaſcular ſyſtem into quicker vibrations; whence a hectical fever will be induced, the fluids will be diſſolved, the ſolids relaxed, colliquative ſweats, and a diarrhæa will come on, and at length, if the purulent fomes cannot be cut off, the patient muſt be exhauſted, and will die tabid.

§. 66. Sometimes it may happen, that even after matter is formed under particular circumſtances, it ſhall be again abſorbed and received into the circulation, and critically depoſited upon ſome other part of the body; if the metaſtaſis ſhould be made from the vital or any of the viſcera to the extremities, it will prove extremely ſalutary, and may be a means of effecting a cure: thus ſometimes in pleuritic and peripneumonic caſes, the diſeaſe has been determined from the breaſt by ſuppurations and diſcharges on the legs and extremities; but if it ſhould be transferred from a leſs to a more noble part, death will frequently be the conſequence: thus an eryſipelas repelled from the face will ſometimes attack the brain, and deliriums, phrenzies, and the like, will ſupervene. Sometimes a peripneumony or inflammation of the lungs has been ſucceeded by a more dangerous phrenzy; whence Hippocrates has remarked, "a peripneumonia phrenitis malum *." The purulent matter in the ſmall-pox being abſorbed into the circulation, and depoſited upon ſome of the viſcera, will occaſion a great many dangerous ſymptoms, peripneumonies, phrenzies, and the like. Under theſe circumſtances, we ſhould endeavour as much as poſſible to divert the flow of humours from the more to the leſs noble parts,

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* Aphoriſm 12. Sect. 7.

If the pulſe ſhould be moderately full and ſtrong, we may make evacuations by blood-letting and ſtool; afterwards bliſters ſhould be liberally applied to the neighbouring parts, and very ſtrongly ſtimulating applications to the feet, ſuch as poultices of bread and milk, with half an ounce or ſix drams of bruiſed muſtard-ſeed. Theſe will frequently remove or leſſen ravings, or the other ſymptoms of a tranſlated inflammation, by determining the flow of humours to the ſtimulated parts; and at the ſame time, by raiſing a conſiderable pain, which ſo affects the mind as to render it leſs ſenſible of the unuſual ſtimulus or irritation in the affected part; whence frequently the phlogiſtic matter will be again taken up, and either determined to the extremities, or expelled from the body by the diſcharge from the bliſters or by urine or ſweat.

§. 67. What has been ſaid concerning inflammation, will lead us to an acquaintance with the nature and general method of treatment of an eryſipelas, or St. Anthony's fire, which diſeaſe ſhould ſeem to be only an inflammation of the ſkin, perhaps from ſome acrimonious particles to be expelled the circulation. By properly moderating the febrile impetus; if too high, by lowering it by evacuations and antiphlogiſtics; if too low, by raiſing it by cordials; by applying a bliſter near the part affected, and emollient fomentations or cataplaſms to the inflammation itſelf, we ſhall rarely fail of remedying this complaint. We may likewiſe underſtand the nature of the acute inflammatory fever, as its cauſes and method of cure are greatly analogous to thoſe of the partial fever, and the doctrine of the one illuſtrated by that of the other.

§. 68. *Have we any certain criterion to diſtinguiſh an inflammatory from a diſeaſe of another kind?* The heat, throbbing pain and fever will generally ſuffice to form a diagnoſis of inflammation: but the pulſe will for the moſt part prove an unerring guide, as it will be always quickened, and moſt frequently full, hard and tenſe; if this ſhould not be quicker than common, we may be convinced that the diſeaſe is not inflammatory. In ſome caſes, where pains in different parts of the body have been exceſſively

ceſſively acute, as in the ſide, back, ſtomach, and the like, the pulſe has neither been quickened nor harder or fuller than natural; under which circumſtances there has been no difficulty to determine that the diſeaſe could not depend upon inflammation, but has generally been owing to a ſpaſmodic, or a periodical cauſe. In moſt inflammations then, the pulſe will be quickened, become fuller and more tenſe, though, as an exception to the fullneſs and hardneſs of the pulſe it has been remarked, that in inflammations of the ſtomach, guts and uterus, the pulſe, though much quickened, often continues ſmall; becauſe, according to Dr. Whytt, on account of the particular ſympathy between their nerves and thoſe of the heart, this muſcle is rendered ſo irritable as to contract before its ventricules are filled with the returning venous blood *.

§. 69. *Have we any rules to judge when an inflammation verges to ſuppuration, or when there may enſue a diſpoſition to gangrene?* It has been ſuppoſed that we may judge of the ſuppuration of an inflammatory tumor by the frequent and involuntary ſhiverings the patient ſhall be attacked with: but if a mortification ſhould have ſupervened, the pulſe will immediately ſink, and become ſcarcely perceptible; cold ſweats and a general languor will ſucceed, the preludes to an approaching diſſolution and inevitable death.

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* Phyſiological Eſſays, Page 67.

THE

CONCLUSION.

§. 70. WE have hitherto been examining the effects of blood-letting, the intentions of cure it can anſwer, and the diſeaſes it ſhould be recommended in: it remains to enquire into the ill conſequences that may ſucceed to its injudicious uſe, and point out the circumſtances which forbid the evacuation. And theſe indeed are many, which in practice are ſtrictly to be attended to, leſt by its indiſcriminate uſe it ſhould prove of more detriment than real ſervice in the cure of diſeaſes.

§. 71. From what has been above obſerved as to its effects, we ſhall eaſily judge under what circumſtances it can be prejudicial; for as it can only act by attenuating the fluids and weakening the circulating powers, it will readily appear, that where the fluids are already too thin, or the circulation and action of the veſſels too languid, blood-letting can be of no advantage, but on the contrary may greatly hurt: a few hints then as to the impropriety of the evacuation under particular circumſtances may, it is preſumed, be of ſervice to the young practitioner, to whom opportunities of remarking the effects of different remedies in different diſeaſes may not frequently have occurred.

§. 72. And firſt, it may happen that even in inflammatory diſeaſes, eſpecially when they have been of ſome days continuance, blood-letting may prove injurious; for if the pulſe, inſtead of being full, high, and tenſe, ſhould be low, weak, and ſoft, it will be expedient to excite rather than lower the vis vitæ; and cordials in this caſe will be the beſt remedies to reſolve the inflammation.

The truth of this has been frequently remarked in pleuritic, peripneumonic, and other inflammatory complaints, where the cooling methods have been too far inſiſted on: the powers of nature and the circulation being too much weakened, the inflammatory cauſe could not be duely concocted or critically expelled the body; ſweat, expectoration, and the other ſalutary excretions have been checked; convulſions, deliria, and the ſymptoms of the low nervous fever have come on; and without nature can be properly ſupported by the warm and generous medicines, ſhe inevitably ſinks under the weight of the diſeaſe.

§. 73. In fevers great caution and judgment are required to bleed with ſafety; as innumerable patients have been deſtroyed by an injudicious uſe of the evacuation. In large cities, and London in particular, the febrile diſeaſes will not in general require the lancet, as they moſtly verge either upon the low nervous, or the putrid kind; conſequently are to be attempted by cordials, and not by antiphlogiſtics. In the country, where the inhabitants are generally more robuſt and plethoric, as their fevers are for the moſt part of the inflammatory kind, evacuations will become neceſſary, leſt the ſymptoms ſhould run ſo high as to prove immediately injurious to life; but in truth, in London we muſt not be too free with the lancet, as great inconveniencies will enſue. It is to be feared, that the practice is in much more general uſe than of general advantage.

§. 74. In the diſeaſes from a weakened and a relaxed ſtate of the ſolids; ſuch as dropſies, leucophlegmatiæ, cachexies, fluor albus, hyſterical and hypochondriacal affections and nervous complaints in general; blood-lettings are manifeſtly injurious, and contradict the general intentions of cure; as in theſe caſes the blood is for the moſt part much attenuated and diſſolved, and the actions of the veſſels too weak and impaired.

§. 75. In the diſeaſes from a ſpontaneous gluten, or a pituitous lentor in the veſſels and viſcera, blood-letting can be rarely required; as in general they owe their origin to a weak ſtate of the primæ viæ, or to a weakened circulation from too rigid a ſtate of the veſſels, the effects of age; and as theſe are maladies that are not to be remedied by an evacuation of this kind, it is certainly unneceſſary to exhauſt the blood and ſtrength of the patient in any caſe where we can propoſe ſo little advantage; and hence in the pituitous apoplexy,

plexy, and its uſual conſequence, the hemiplegia or palſy; as well as in the jaundice and all other diſeaſes from viſcidities, we rather hurt than benefit the patient by drawing away blood.. Even in the peripneumonia notha or humoral Aſthma, provided there ſhould be no tendency to inflammation, or indeed in conſumptive coughs, it is much to be doubted whether thoſe advantages are to be reaped from blood-letting as have been generally imagined, at leaſt my own obſervations have not convinced me of it; for though I can readily grant that the reſpiration has been eaſier and freer for ſome hours after the operation, which indeed muſt neceſſarily follow from a depletion of the veſſels in general, of conſequence of the lungs likewiſe; yet in a day or two the dypſnæa will return with aggravated violence, frequently attended with ſwelled legs and other ſymptoms, from an impoveriſhed ſtate of the fluids. Nor does it appear that frequent blood-lettings in a confirmed conſumption are of that ſervice we ſhould be induced to believe from ſo great an authority as that of Dr. Mead; as for the moſt part they only tend to weaken the patient, and haſten him to his end.

§. 76. In the diſeaſes from a putreſcent acrimony or ſpontaneous putrefaction of the humours, ſuch as the ſea-ſcurvy, and the like, an evacuation of blood will be manifeſtly prejudicial, and can anſwer no good purpoſe.

§. 77. In ſhort, in all caſes from a relaxed ſtate of the ſolids, a diſſolved ſtate of blood, and a weak, languid circulation, blood-letting muſt be avoided, as encreaſing all the ſymptoms, and contrary to all the intentions of cure.

FINIS.